Lessons in Outsourcing — CH-47F Design and Production Effort Initiatives

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Since the late 1960s, the CH-47 Chinook has remained the Army's only heavy-lift helicopter on the battlefield. The new CH-47F Improved Cargo helicopter was developed and is beginning production to address the current age of the CH-47D fleet and close the technology gaps between its capabilities and warfighters' current needs for communication and situational awareness. The CH-47F includes improvements such as a digital cockpit, digital automatic flight control system, monolithic machined structure and reduced structural vibration. Boeing Helicopters, the prime contractor, is meeting the challenge of managing a mixed-model production line while producing our F model, the MH-47G model for the Technical Applications Project Office and a limited number of CH-47s for various foreign military sales (FMS) and direct sale customers.

Continuing operational and environmental challenges have led to the development of a new CH-47F Improved Cargo helicopter to better address Soldier requirements. The new CH-47F has improved digital cockpits and digital automatic flight control systems. (Photo by Mark Casey, U.S. Army Aviation Technical Test Center Flight Test Engineer.)

Like most programs, product configuration has been changing since its inception. Initially, new-built aircraft were going to incorporate the newly designed monolithic machined frame, and remanufactured aircraft would use salvaged airframes from D model aircraft inducted from the field. After producing two CH-47F Engineering, Manufacturing and Development aircraft, plans were in place to produce seven more remanufactured F model aircraft during the program's low-rate initial production (LRIP) phase. However, because of a more immediate need for current CH-47 aircraft, LRIP was cut to one aircraft. Prior to the first LRIP F model, a business case was presented to have all CH-47Fs built with the new machined structure and eliminate the need for salvaged D model airframes. The production schedule shift afforded the CH-47F program the opportunity to take advantage of this change. Additionally, the prime contractor made the process more economically feasible by outsourcing specific areas.

Shifting this workload from the prime contractor to suppliers with specific core competencies has contributed directly to the CH-47F program's success. In this article, we discuss how open communication and early coordination can prevent potential problems with outsourcing in the areas of aircraft design, production and inventory management.

Communicate and Coordinate During System Design Outsourcing

The CH-47F program used varying design concepts in different airframe sections to incorporate past improvements

A key contributor to CH-47F program success is an effective system to manage and resolve quality issues. The same exacting standards will be applied to the CH-47D remanufacturing process. Here, SSG Robert Urvina, Bravo Co., 6th Battalion, 101st Aviation Regiment, 101st Airborne Division, preflights a CH-47D at Forward Operating Base (FOB) Speicher, Tikrit, Iraq. (U.S. Army photo by SPC Teddy Wade, 55th Signal Co. (Combat Camera).)

from direct commercial sales and new improvements designed to address structural issues the Army experienced. We enlisted support from an experienced aircraft design contractor for a redesign of the aft section. The contractor completed this new design using 3-D models created with Unigraphics®. The design methods for the cabin section differed in that we primarily used legacy designs, which used 2-D drawings that were shared with previous FMS, direct commercial sales and D model aircraft. We also chose to redesign some of the aircraft's cockpit sections at the prime contractor using Catia V4. The decision to use a combination of design sources and tools instead of a common method was influenced by funding and schedule requirements.

Prior to the work they performed on the CH-47F, the aft section designers had experience with fixed-wing aircraft design. The paradigms for designing fixed-wing aircraft aerodynamics are different than those of rotorcraft design, but these differences were not apparent until late in the assembly process. We found that the outside surface of the first few newly designed aft sections did not fit within tolerance when spliced to the cabin sections. If a common software package had been used for aft and cabin section design, we may have been able to prevent the mismatch of these major sections. In addition, increased coordination between the two design groups regarding the expected ground rules for structural design might have prevented the oversight earlier in the process. If the choice is made to outsource design, it is suggested that you should establish common tools and paradigms. If circumstance warrants that this is not possible, be aware that there may be some trade-offs with the need for greater coordination during the design process.

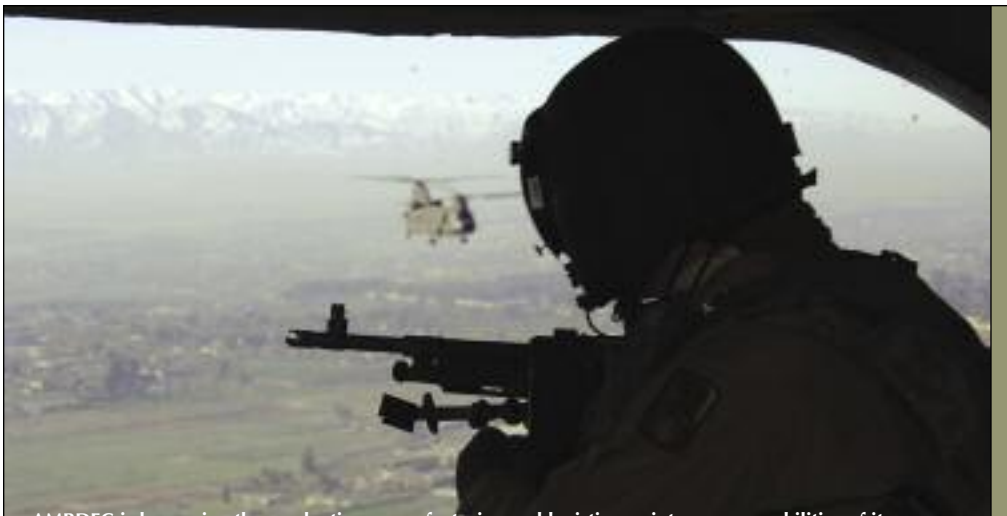
CH-47 Chinook helicopter integrated inventory management systems will significantly reduce lost, mishandled or late material. Here, a CH-47D crew chief preflights a CH-47D Chinook helicopter at FOB Summerall, Iraq, last summer. (U.S. Army photo by SSG Alfred Johnson, 55th Signal Co. (Combat Camera).)

Provide Continuous Feedback During Production Processes Outsourcing

Along with outsourcing some design effort, the prime contractor also chose to outsource some production processes as well. One outsourced process was the cabin section subassembly. Periodically, the subcontractor had difficulty interpreting the legacy drawings because they were not familiar with the prime contractor's system. However, they were required to manage structural part configuration for which they had production responsibility. Initially, the system used to manage the ongoing changes to configuration lacked the proper checks and balances. Because of this, we experienced some configuration issues involving fasteners and materials. The program's quality-monitoring processes captured these issues and drove corrective action back to the problems' origins. This emphasizes the importance that feedback occurs to acknowledge a change was received, understood and incorporated. An outsourcing effort of this nature requires significant engineering support and oversight early in the process to minimize problems during production start-up.

Shared Knowledge From Past Experience on Outsourced Production Processes

The prime contractor also chose to outsource the aft section subassembly. The subcontractor was provided with 3-D models from the recent aft section design. They were familiar with using these software models in the work they had performed for other programs and,



AMRDEC is leveraging the production, manufacturing and logistics maintenance capabilities of its industry partners to develop the new CH-47F Chinook helicopter and remanufacture the current fleet of CH-47Ds. Here, SPC Tim Parson, A Co., 7th Battalion, 158th Aviation Regiment, provides security aboard a CH-47D Chinook en route to several FOBs near Naray, Afghanistan, last January. (U.S. Army photo by SSG Michael L. Casteel, 982nd Signal Co. (Combat Camera).)

as a result, the aft section production contractor was able to apply lean concepts in a green field approach to the assembly process. Taking a fresh approach resulted in meeting the program's expectations for quality and schedule performance. However, one weakness in taking a new approach is that tribal knowledge of the production process is often missing and the loss of such knowledge may not be evident until production problems arise. During ramp-up to full-rate production, the CH-47F program experienced some of these production problems because of a lack of assembly process experience. Many of these problems may have been overcome earlier in the production process if experience with aft section assembly processes had been retained.

Integrate Systems for Resolving Quality Issues

One key contributor to the CH-47F program's success has been the use of an effective system to manage and resolve quality issues. The cabin and aft section assembly contractors are the two major suppliers for the program's structural parts, and both use systems that are integrated with the prime contractor's production quality system. The process is a formalized way of communicating, documenting and resolving any nonconformance that occurs in the manufacturing process. This process has allowed us to resolve discrepancies without a significant impact to the production line.

Integrate Inventory Management Systems When Outsourcing Logistics Functions

Inventory management was also outsourced. A third-party logistics contractor was tasked with warehousing the contractor- and government-furnished equipment used in CH-47F production. They also built up point-of-use kits for the prime contractor's assembly processes, enabling the workforce to easily determine what parts were needed for assembly based on work instructions. The transformation to point-of-use kitting has helped to eliminate time wasted searching for required material. Outsourcing these services also allowed the prime contractor to concentrate on its core competencies — rotorcraft design and assembly — rather than inventory management. As a lookout, it is essential to fully integrate the manufacturer's purchasing and manufacturing execution systems with the third party's logistics warehouse management system. If these systems cannot communicate correctly, there is an inherent potential for lost, mishandled or late material.

Open and early communication is a vital contributor to any program's success. Program managers and their teams must make a concerted effort at the program's beginning to break down barriers between the government and its respective contractors to ensure that communication lines are open and adequate. These lines of communication and relationships will require maintenance throughout the program's life cycle. When you choose to take advantage of the benefits of outsourcing, understand that communication becomes more difficult because of the natural barriers that exist between companies. Breaking down these barriers will help ensure that you leverage full advantage of your partnerships. In turn, this will help DOD develop and field effective products for our warfighters where and when they need them most.

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